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US 5487221 A US 5306025 A US 3823473 A

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(54) Abstract Title

Quick-action chuck for a hand tool machine

(57) In a hand tool machine having an electric motor-operable drive element (14) for a tool (16) and a quick-action chuck (15) disposed on the drive element (14) for clamping the tool (16), which quick-action chuck comprises a clamping sleeve (18) held rotatably on the free end of the drive element (14) and clamping means coupled to the clamping sleeve (18) for automatically clamping the tool upon rotation of the clamping sleeve (18), a torsion spring (19) for rotating the clamping sleeve (18), as well as a tool ejector (22) which simultaneously holds the quick-action chuck (15) in its open position, for the purpose of reliable centring and bracing of the tool shank (161) in the quick-action chuck (15), the clamping means take the form of clamping jaws (20, 21), which lie diametrically opposite one another and are guided in a radially displaceable manner in the guide sleeve (17) and coupled for their displacement movement to the clamping sleeve (18).

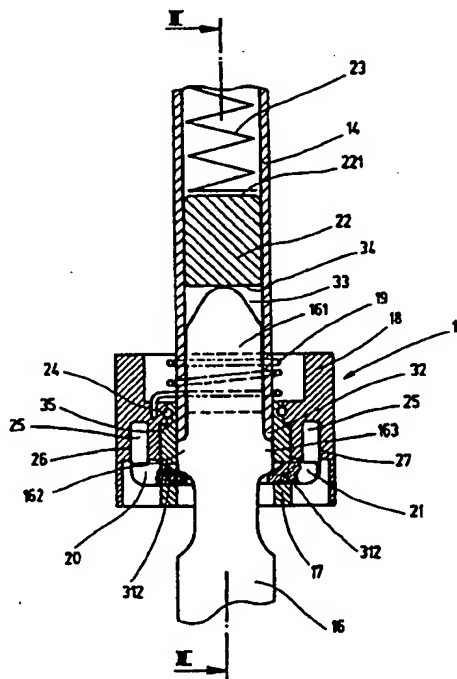


Fig. 2

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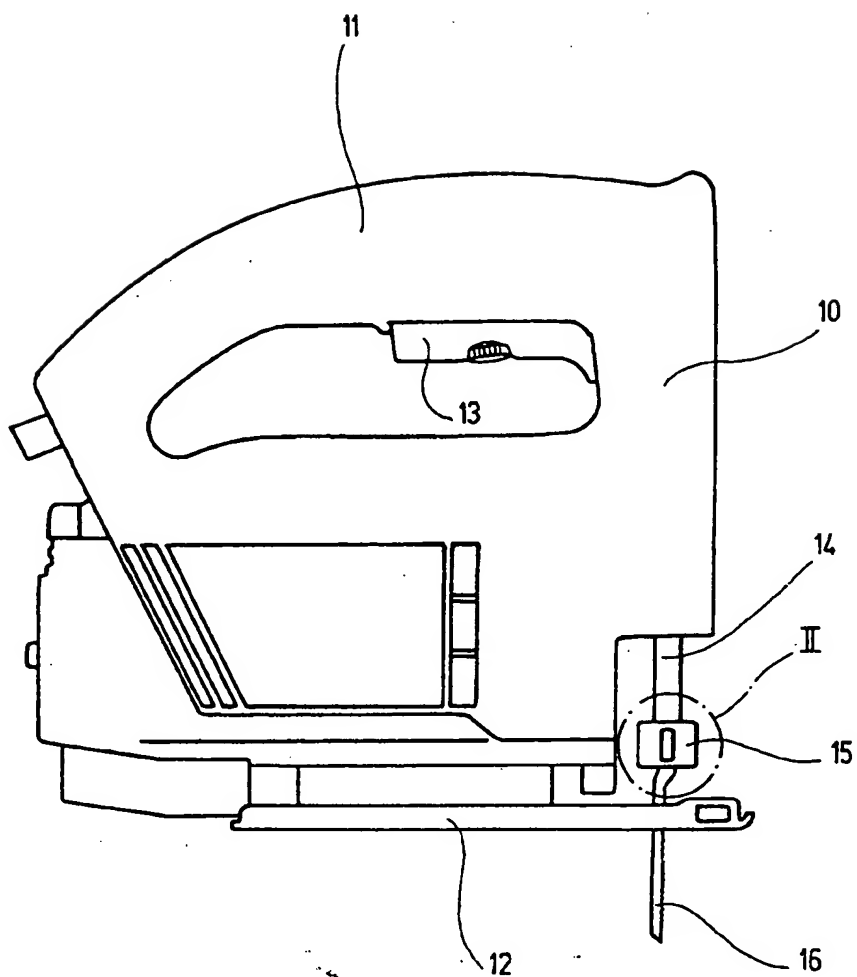


Fig. 1

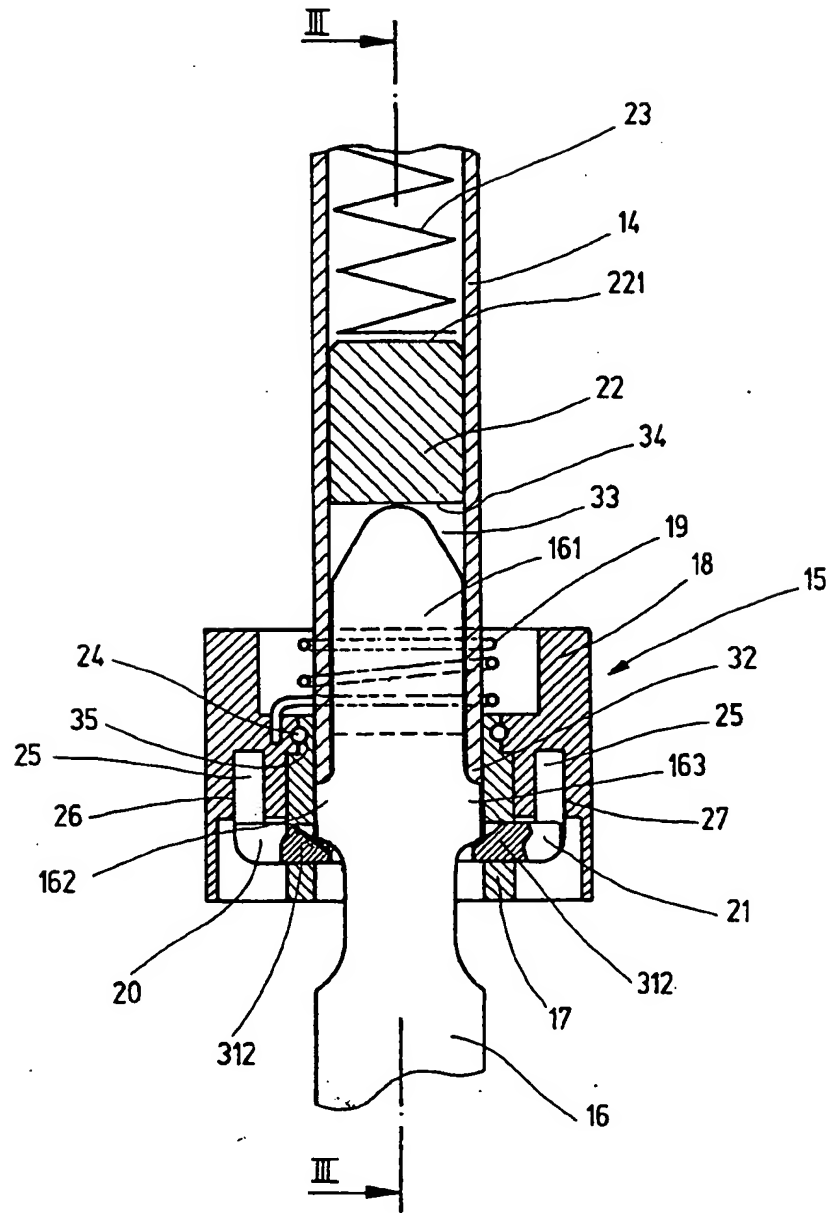
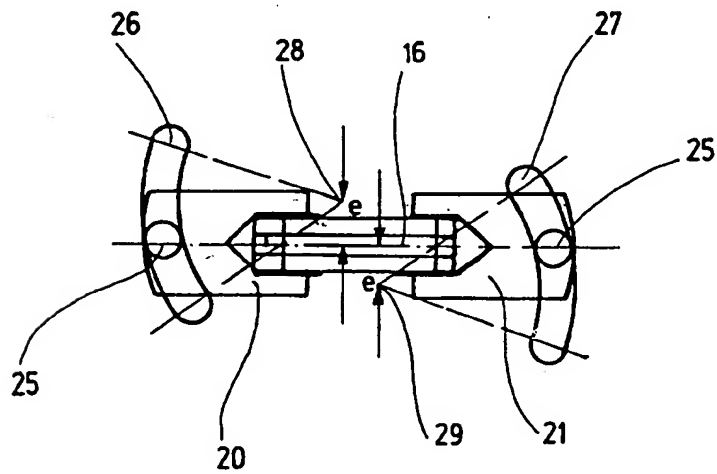


Fig. 2



Fig. 3



Hand tool machine

The invention proceeds from a hand tool machine of the type defined  
5 in the preamble of claim 1.

With such a hand tool machine, tool changing is possible very quickly and by single-handed operation. When the quick-action chuck holds no tool, the tool ejector ensures that the quick-action chuck is automatically held open so that a new tool may be introduced without any prior manipulation of the quick-  
10 action chuck and without the use of auxiliary means. By virtue of insertion of the tool shank into the quick-action chuck, the tool ejector is displaced counter to the action of an ejection spring and hence releases the quick-action chuck for automatic locking of the tool. As soon as the tool ejector has been moved out of its blocking position, the tensioned torsion spring rotates the clamping sleeve with  
15 clamping disc and the tool is clamped firmly between drive element and clamping disc. When the tool is to be changed, the clamping sleeve has to be rotated by hand counter to the action of the torsion spring. The tool is therefore released, and the tool ejector loaded by the ejection spring pushes the tool out of the chuck and finally arrives back in its arresting position, in which the quick-action chuck is  
20 held open.

For realizing such a quick-action chuck for a hand-held jig saw machine, it has already been proposed to fix the clamping disc, which is provided with a slot-type opening, on a cap which is held rotatably on an annular flange at the free end of a hollow-cylindrical lifting rod forming the drive element. The unit  
25 comprising cap and clamping disc is enclosed by a collar and non-rotatably connected to the latter. The torsion spring acts, on the one hand, upon the collar and, on the other hand, upon the lifting rod. The clamping disc on its disc face facing the lifting rod end carries two ramps which, upon rotation of the collar with

unit comprising cap and clamping disc, run up onto the bottom edge of the clamping straps on the saw blade and hence brace the saw blade, which is supported against the end face of the lifting rod, towards the lifting rod end. For centring the saw blade, the annular lifting rod end is provided with a diametrical, V-shaped groove, into which the clamping straps on the saw blade shank are pressed. The tool ejector, which is used simultaneously to hold the quick-action chuck open, is guided inside the lifting rod in vertical grooves in the rod inner wall so as to be locked against rotation. On the bottom end of the tool ejector a pair of limbs is formed in such a way that the limbs in the open position of the quick-action chuck are aligned with arresting holes in the clamping disc and under the action of an ejection spring engage at one end into said arresting holes and hence prevent the clamping disc from being rotated by the tensioned torsion spring.

The hand tool machine according to the invention having the features of claim 1 has the advantage that the tool is not only braced and centred in axial direction but also clamped and centred laterally. As a result, an absolutely correct seating of the tool in the quick-action chuck is guaranteed and a rotation of the tool during operation, even in the event of substantial transverse moments, is reliably ruled out. When the tool takes the form of a saw blade for a hand-held jig saw machine, the centring is additionally improved by providing V-shaped grooves both in the front end of the drive element designed as a hollow-cylindrical lifting rod and also in the clamping jaws, with the result that even saw blades of differing thickness are centred extremely well in the quick-action chuck.

Advantageous developments and improvements of the hand tool machine indicated in claim 1 are possible by virtue of the measures outlined in the further claims.

There now follows a detailed description of an embodiment of the invention which is illustrated in the drawings. The drawings show:

Figure 1 a side view of a hand-held jig saw, partially diagrammatically illustrated;

Figure 2 an enlarged view of the cutout II in Figure 1 in longitudinal section;

5 • Figure 3 a section along the line III-III in Figure 2;

Figure 4 a perspective view of clamping jaws in the quick-action chuck according to Figures 2 and 3;

Figure 5 a diagrammatic plan view of the clamping jaws in Figure 4 in their state of coupling to a clamping sleeve of the quick-action chuck.

10 The hand-held jig saw, which is diagrammatically illustrated as an example of a hand tool machine in side view in Figure 1, comprises a machine housing 10, on which a handle 11 for guiding the hand-held jig saw is formed, wherein the hand-held jig saw is placed with a supporting plate 12 onto a workpiece to be sawn. Projecting from the underside of the handle 11 is an  
15 operating button 13, which cooperates with an electrical switch disposed in the circuit of an electric motor. The electric motor, which is accommodated in the machine housing 10, via a gear unit comprising an eccentric drive sets a lifting rod 14, which is guided in an axially displaceable manner in the machine housing 10, into a reciprocating lifting motion. A quick-action chuck 15 for clamping a saw  
20 blade 16 is disposed on the free end of the lifting rod 14 projecting out of the machine housing 10. As is evident from the enlarged view of Figs. 2 and 3, the saw blade 16 comprises two clamping straps 162, 163 protruding transversely from the saw blade shank 161 for clamping the saw blade 16 in the quick-action chuck 15.

25 The quick-action chuck 15 is so designed that the saw blade 16 may be inserted without additional manipulation or additional aids into the quick-action chuck 15 and, after insertion of the saw blade 16, the saw blade 16 is automatically firmly clamped. For changing the saw blade 16, the quick-



action chuck 15 is to be operated single-handedly, wherein the saw blade 16 is automatically ejected and the quick-action chuck 15 is held in its open position until a new saw blade is introduced.

For said purpose, the quick-action chuck 15 specifically comprises

5 a guide sleeve 17, a clamping sleeve 18, a torsion spring 19, two identically designed clamping jaws 20, 21, an ejector 22 and an ejection spring 23. The guide sleeve 19 is slipped onto the end of the hollow-cylindrical lifting rod 14 and firmly connected to the latter, e.g. by welding or soldering. The clamping sleeve 28 is fastened in a rotatable and axially non-displaceable manner on the guide sleeve 17

10 by means of a snap or spreader ring 24. The spreader ring 24 is held in a circumferential groove 35 worked in the circumference of the guide sleeve 17. The torsion spring 19 acts, on the one hand, upon the clamping sleeve 18 and, on the other hand, upon the guide rod 14. The clamping jaws 20, 21, a perspective view of which is shown in Figure 2, are disposed diametrically opposite one

15 another and accommodated in a radially displaceable manner in the guide sleeve 17. They are coupled to the clamping sleeve 18 in such a way that, upon rotation of the clamping sleeve 18, they execute a radial displacement movement in the guide sleeve 17 which is directed either towards or away from one another depending on whether the clamping sleeve 18 is being rotated in the one or the

20 other direction of rotation. For coupling the clamping jaws 20, 21 to the clamping sleeve 18, each clamping jaw 20 or 21 carries a transversely projecting, axially extending guide pin 25, and worked in the clamping sleeve 18 are two diametrically opposed, curved slot-type recesses 26, 27, into which the guide pins 25 project. The depth of the slot-type recesses 26, 27 is greater than

25 the axial length of the guide pins 25, and the slot width is slightly greater than the outside diameter of the guide pins 25. The two slot-type recesses 26, 27 are disposed in such a way that their two centres of curvature 28, 29 (i.e. the centres of their radii of curvature) are offset in opposite directions by an identical extent

of eccentricity "e" from the diameter line of the clamping sleeve 18 (Figure 5). When the clamping sleeve 18 is moved - in Figure 5 - in clockwise direction, the clamping jaws 20, 21 are displaced radially outwards and, when the clamping sleeve 18 is moved in anti-clockwise direction, the clamping jaws 20, 21 move  
 5 towards one another.

On faces directed towards one another the clamping jaws 20, 21 have in each case a fork-shaped opening 30 (Figure 4), the opening width of which is slightly greater than the shank thickness of the thickest saw blade 16 intended for use in the quick-action chuck 15. Introduced in the fork base of each opening  
 10 30 is a V-shaped groove 31, the groove flanks 311 and 312 of which extend from the top surface of the clamping jaw 20 or 21 facing the lifting rod 14 obliquely down towards the fork opening 30. A V-shaped groove 32 of an identical type is worked diametrically into the annular front end of the lifting rod 14 facing the clamping jaws 20, 21 (Figure 2). The two fork-shaped openings 30 in the two  
 15 clamping jaws 20, 21 lying diametrically opposite one another in the guide sleeve 17 form a slot-like insertion opening for introduction of the saw blade shank 161. In the open state of the quick-action chuck 15, i.e. when the two clamping jaws 20, 21 are spaced the maximum distance apart by the clamping sleeve 18, the length of the insertion opening is greater than the sum of the width of the saw blade  
 20 shank 161 and the height of the two clamping straps 162 and 163 protruding from the saw blade shank 161. By rotating the clamping sleeve 18, the length of the insertion opening is shortened to the width of the saw blade shank 161. The clear inside diameter of the lifting rod 14 is made slightly larger than the width of the saw blade shank 161 so that the inner wall of the lifting rod 14 also performs a  
 25 guiding function for the saw blade shank 161.

The ejector 22 loaded by the ejection spring 23 is guided in an axially displaceable manner inside the lifting rod 14, wherein the ejection spring 23 in the form of a compression spring is supported on the one hand against the

end face of the ejector 22 and on the other hand in the lifting rod 14. In the open state of the quick-action chuck 15, the ejector 22 engages between the two clamping jaws 20, 21 and is supported axially against a stop formed inside the guide sleeve 17. The ejector 22 has a diametrical, slot-shaped recess 33, which  
 5 is congruent with the insertion opening formed by the openings 30 of the two clamping jaws 20, 21 and in the base of which a V-shaped groove 34 is formed for receiving the front end of the saw blade shank 161.

The mode of operation of the quick-action chuck 15 described above is as follows:

10 In the open state of the quick-action chuck 15, the saw blade 16 is introduced by its saw blade shank 161 into the insertion opening formed by the two fork-shaped openings 30 of the two clamping jaws 20, 21. In the process, the front end of the saw blade shank 161 lying in the recess 33 of the ejector 22 pushes into the V-shaped groove 34 at the base of the recess 33. As a result of  
 15 further insertion of the saw blade 16, the ejector 22 is displaced counter to the action of the ejection spring 23 into the lifting rod 14 until the ejector 22 clears the two clamping jaws 20, 21. The tensioned torsion spring 19 then comes into effect and rotates the clamping sleeve 18 in such a way that the two clamping jaws 20, 21 move towards one another. The groove flanks 311 and 312 of the two  
 20 V-shaped groove 31 in the clamping jaws 20, 21 engage under the bottom edge of the clamping straps 162, 163 on the saw blade shank 161 and press the saw blade 16 upwards, with the result that the top edges of the clamping straps 162, 163 are pushed into the V-shaped groove 32 at the end face of the lifting rod 14. The saw blade 16 is therefore braced by its clamping straps 162, 163 between the  
 25 lifting rod 14 and the clamping jaws 20, 23, wherein the V-shaped grooves 31, 32 provide for a centring of the saw blade 16. In addition, the ejector 22 under the action of the ejection spring 23 presses upon the end face of the saw blade shank

161 and, here too, the V-shaped groove 34 provides for a centring of the shank end of the saw blade 16.

When the saw blade 16 is to be changed, the quick-action chuck 15 has to be opened, for which purpose the clamping sleeve 18 has to be rotated  
5 single-handedly, simultaneously tensioning the torsion spring 19. By virtue of said rotation of the clamping sleeve 18, the pin-and-slot connections 25, 26 and 25, 27 of the clamping jaws 20, 21 to the clamping sleeve 18 cause the clamping jaws 20, 21 to be moved radially outwards so that the clamping jaws 20, 21 progressively release the clamping straps 162, 163. As soon as the clamping jaws  
10 20, 21 have been pulled sufficiently far apart, the ejector 22 pushes the saw blade 16 out and simultaneously moves in between the opposing fork ends of the two clamping jaws 20, 21, with the result that the clamping jaws 20, 21, when the clamping sleeve 18 is let go, are arrested and prevented from moving back again. The quick-action chuck 15 is situated in its open position and a new saw blade  
15 may be introduced in the described manner into the quick-action chuck 15 without requiring any prior manipulation of the quick-action chuck 15. After upward movement of the saw blade 16, the latter is then likewise automatically and reliably centred and clamped in the quick-action chuck 15 without any kind of manipulation by the operator.

CLAIMS

1. Hand tool machine having an electric motor-operable and, at least at its free end, hollow-cylindrical drive element (14) for a tool (16), having a  
5 quick-action chuck (15) seated on the free end of the drive element (14) for clamping the tool (16), which has clamping straps (162, 163) protruding transversely from the tool shank (161), which quick-action chuck comprises clamping means (17, 20, 21) having an insertion opening for the tool shank (161),  
10 a clamping sleeve (18) which is held rotatably on the free end of the drive element (14) and through rotation braces the tool shank (161) between the drive element end and the clamping means, a torsion spring (19) acting on the one hand upon the drive element (14) and on the other hand upon the clamping sleeve (18), and a tool  
ejector (22) which is guided non-rotatably in the drive element end and simultaneously in the open state of the quick-action chuck (15) arrests the  
15 clamping sleeve (18) against rotation by the tensioned torsion spring (22) and by means of its axial displacement effected upon insertion of the tool shank (161) into the insertion opening cancels the arresting action, characterized in that the clamping means comprise a guide sleeve (17), which is fastened to the drive  
element (14), and two clamping jaws (20, 21), which lie diametrically opposite  
20 one another in the guide sleeve (17) and are guided in a radially displaceable manner in the guide sleeve (17) and coupled for their displacement movement to the clamping sleeve (18).
2. Machine according to claim 1, characterized in that the coupling  
25 between clamping sleeve (18) and clamping jaws (20, 21) takes the form of a pin-and-slot guide.

3. Machine according to claim 2, characterized in that from each clamping jaw (20, 21) a guide pin (25) projects at right angles to the direction of displacement and the clamping sleeve (18) has two diametrically opposed, curved slot-type recesses (26, 27), which are disposed in such a way that their centres of curvature (28, 29) are offset in opposite directions by an identical extent of eccentricity (e) from the diameter line of the clamping sleeve (18).  
5
4. Machine according to one of claims 1 - 3, characterized in that the clear diameter of the guide sleeve (17) is slightly greater than the sum of the diameter of the tool shank (161) and the width of the clamping straps (162, 163) protruding transversely at a diametrical side of the tool shank (161).  
10
5. Machine according to one of claims 1 - 4, characterized in that the guide sleeve (17) is slipped onto the drive element end and rigidly connected, e.g. welded, soldered or the like, to the latter.  
15
6. Machine according to one of claims 1 - 5, characterized in that the clamping sleeve (18) is fastened rotatably on the guide sleeve (17).
- 20 7. Machine according to claim 6, characterized in that the rotatable fastening of the clamping sleeve (18) on the guide sleeve (17) is effected by means of a snap or spreader ring (24), which is situated in an axially non-displaceable manner in a groove (35) in the guide sleeve (17).
- 25 8. Machine according to one of claims 1 - 7, characterized in that the tool ejector (22), which is loaded by an ejection spring (23), in the open state of the quick-action chuck (15) lies against a stop formed on the guide sleeve and in

so doing engages between the clamping jaws (20, 21), preventing the latter from moving towards one another.

5 9. Machine according to one of claims 1 - 8, characterized in that the drive element is a lifting rod (14) and the tool is a saw blade (16) and that introduced into the annular free front end of the lifting rod (14) is a diametrical V-shaped groove (32) for supporting the clamping straps (162, 163) protruding transversely from the saw blade shank (161).

10 10. Machine according to claim 9, characterized in that the clamping jaws (20, 21) on surfaces directed towards one another have in each case a fork-shaped opening (30), the opening width of which is greater than the shank thickness of a saw blade (16) to be received in the quick-action chuck (15), and that introduced in the opening base of the fork-shaped opening (30) is a V-shaped  
15 groove (31), the groove flanks (311, 312) of which extend from the top surface of the clamping jaws (20, 21) facing the lifting rod (14) obliquely down towards the fork opening.

20 11. A hand machine tool substantially as herein described with reference to the accompanying drawings.



Application No: GB 9909593.7  
Claims searched: 1 to 11

Examiner: Graham S. Lynch  
Date of search: 6 October 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.Q): B5L (LMB)  
Int Cl (Ed.6): B23D 51/08, 51/10, 51/12, 51/14; B25F 5/00; B27B 19/00, 19/02, 19/06,  
19/09, 19/10, 19/12, 19/14; B27C 7/04  
Other: On-line : WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X, P	GB 2322593 A BOSCH. See whole document.	1, 4.
Y	EP 0732165 A1 BOSCH. See whole document.	6.
X	WO 96/28273 SCINTILLA. Note especially Figures 1, 3, 6, 10a, 10b.	X - 1, 4, 9.
Y		Y - 5, 6, 7.
Y	US 5487221 ODA et al. See whole document.	6.
Y	US 5306025 LANGHOFF. See Figures 6, 7, 10, 11. Column 3, line 30 to column 7, line 54.	6, 7.
Y	US 3823473 HOFFMAN. See Figures 8, 9. Column 7, line 47 to column 8, line 65.	6.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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